

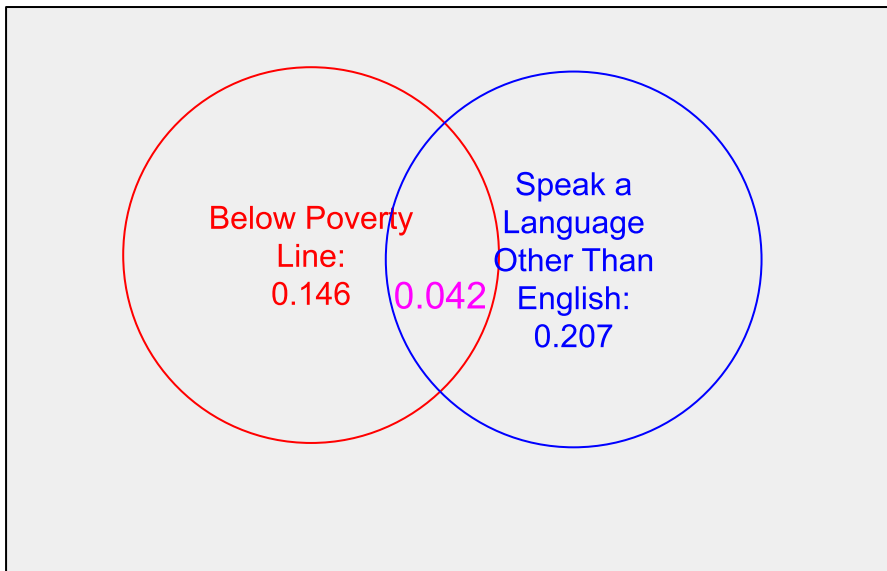
# Homework 2

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1.

a. No, 4.2 of people fall into both categories, so they are not disjoint.

b.



c.

live below poverty line = B

only speak English = E

$$P(B \cap E) = 0.042$$

d.

$$P(B \cup E) = P(B) + P(E) - P(B \cap E) = 0.146 + 0.207 - 0.042 = 0.311$$

e.

$$P(B^c \cap E) = P(B^c)P(E) = 0.854 \cdot 0.207 \approx 0.178$$

f.

$$P(B \cap E) = 0.042$$

$$P(B)P(E) = 0.03022$$

Because these are not equal, they are independent. Living below the poverty line and speaking a foreign language at home are not independent events and knowing one gives us some information about the other.

2.

- a. In order to have the first that she gets correct be the fifth question, she needs to get the first 4 incorrect AND get the fifth correct.

$$P(\text{first four incorrect}) = 0.75^4$$

$$P(\text{last one correct}) = 0.25$$

$$P(\text{first four incorrect} \cap \text{last one correct}) = 0.75^4 \cdot 0.25 = 0.0791$$

- b. The probability that she gets all of the questions right (assuming independent answers due to randomness) is  $P(\text{all correct}) = 0.25^5 = 0.000977$  (not a good idea to guess on a test).
- c. The probability of getting at least one correct is the same as not getting all of them wrong.

$$P(\text{at least one correct}) = 1 - 0.75^5 = 0.763$$

3.

a.

$$P(Bl_m \cup Bl_f) = \frac{114}{204} + \frac{108}{204} - \frac{78}{204} = 0.706$$

b.

$$P(Bl_f|Bl_m) = \frac{78}{114} = 0.684$$

c.

$$P(Bl_f|Br_m) = \frac{19}{54} = 0.352$$

$$P(Bl_f|Gr_m) = \frac{11}{36} = 0.306$$

d. They do not appear to be independent as the probabilities change depending on what they condition on. This is especially true for blue-blue pairs, which has a probability much higher than brown-blue and green-blue (where the first color is the male).

4.